Shell Marine Products

SHELL ALEXIA S4

PROVEN PERFORMANCE UNDER TOUGH CONDITIONS

Shell Alexia S4 is a completely new formulation built on a breakthrough in the understanding of oil stress in low-speed, two-stroke diesel engines and the need for reduced costs and greater operational simplicity.

Shell Alexia S4

THE NEED FOR A NEW CYLINDER OIL

Shell has a long history of anticipating industry needs and responding through technical innovation. This is the result of an ongoing, systematic technology road-mapping process whereby the challenges that exist today are understood and future challenges are forecast to identify areas that are critical to meeting our customers' needs. Shell continues to use this process to drive its marine lubricants innovation pipeline.

The shipping industry is facing major challenges in a tough market environment that is undergoing significant change. Legislation is creating requirements to use different fuels that add operational complexity. Pressure to lower operating costs is increasing and being driven by rising fuel prices, and a sometimes volatile commercial environment. Many ship operators are reducing cylinder oil feed rates and also want to increase their maintenance intervals. Slow and ultra-slow steaming have also been widely implemented by the shipping industry as cost-saving measures.

Lubricant manufacturers have responded to operators' changing needs in different ways, including advocating the need to maintain a range of cylinder oils. The requirement to use multiple products to deal with different operating conditions, such as moving in or out of an emission control area (ECA), increases the operational complexity for the ship crew, as it requires additional storage, decanting and drum disposal operations.

At Shell, we feel and understand the uncertain world our industry faces. In response to these challenges, we have worked hard to remove complexity by providing a single, all-purpose cylinder oil, Shell Alexia S4, that is designed to deliver flexibility for our customers and help them to meet the challenges they face in running their vessels in a dynamic operating environment.

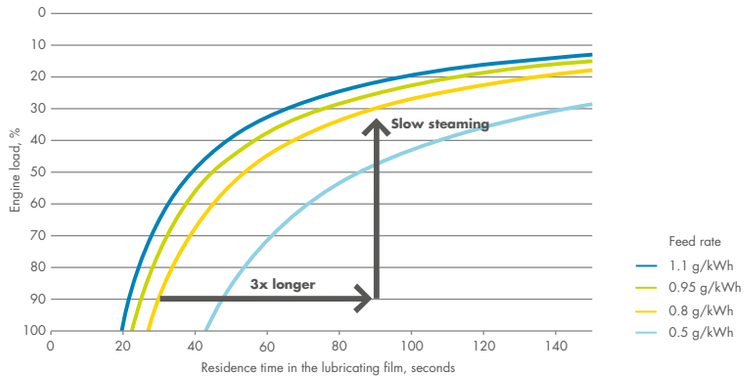
MANY SHIP OPERATORS ARE REDUCING CYLINDER OIL FEED RATES AND ALSO WANT TO INCREASE THEIR MAINTENANCE INTERVALS. SLOW AND ULTRA-SLOW STEAMING HAVE ALSO BEEN WIDELY IMPLEMENTED BY THE SHIPPING INDUSTRY AS COST-SAVING MEASURES.

CYLINDER OIL REINVENTED TO MEET YOUR NEEDS

Oil stress in a lubricant causes the product to degrade and become less effective. Recently, Shell made important discoveries about oil stress in two-stroke engines. We now understand that two-stroke engine cylinder oil is exposed to four oil-stress factors (thermal, insolubles, acid and humidity) and that these stresses increase significantly under slow-steaming conditions because of the longer oil residence time in the cylinder. In fact, a reduction in engine load from 90 to 30% was found to cause a threefold increase in lubricant residence time.

Shell Alexia S4 is a completely new formulation that has been developed from our breakthrough understanding of oil stress in two-stroke engines.

- **Thermal stress**
- **Insolubles stress**
- **Acid stress**
- **Humidity stress**



THREE TIMES LONGER: Plotting oil residence time against engine load for a fixed feed rate shows that slow steaming may force the oil to work for three times longer than at normal steaming speeds.

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PRODUCT CHARACTERISTICS

Shell Alexia S4

- is a single, all-purpose cylinder oil for low-speed, two-stroke diesel engines that replaces Shell Alexia 50 and Shell Alexia LS
- can be used with distillates* and residual fuel oil containing up to 3.5% sulphur under different engine loads and across a wide range of operating conditions
- has an SAE 40 viscosity grade that aids oil spreading inside the engine to improve the efficiency of the lubrication system
- has a base number (BN) of 60, but can be used at the same feed rate as BN70 cylinder oils.

*Up to 1,000 hours; see your technical manager for more details and suitability of use.

OPERATIONAL SIMPLICITY

Until recently, using a dedicated cylinder lubricant with low-sulphur fuel was the best way to meet operational needs. But, as our ongoing technology road-mapping process shows us, the marine industry is changing rapidly. There is now the need for a flexible lubricant that offers superior performance in a wider and harsher operating envelope.

Our awareness of these operational needs and rigorous scientific understanding of oil stress have led to the reinvention of cylinder lubrication in the form of Shell Alexia S4. This completely new formulation is designed as an all-purpose cylinder oil that is suitable for use with the widest range of operating conditions, fuel specifications, engine and vessel types.

It replaces Shell Alexia 50 and Shell Alexia LS, so eliminates the need to carry two products. This simplifies operations in several ways:

- It is a single, all-purpose cylinder oil that can be used with distillates* and residual fuel oil with up to 3.5% sulphur levels and in all environments: polar to tropical.
- It offers easier product supply, procurement and forecasting, and the simplest product storage and handling options, which reduces or eliminates the need for intermediate bulk containers or drums.
- It avoids the need for a lubricant change when moving in and out of ECAs.
- The risk of selecting the wrong product is eliminated and crew training is simplified.
- It has better supply security because it can be blended with either Group 1 or Group 2 base oils, the additive formulation has been prescribed by Shell to use components that are widely available, and it is blended in more than 30 plants worldwide.
- It is available from about 500 ports worldwide.
- It is fully miscible with all other cylinder oils, which means an easy changeover process.

*Up to 1,000 hours; see your technical manager for more details and suitability of use.

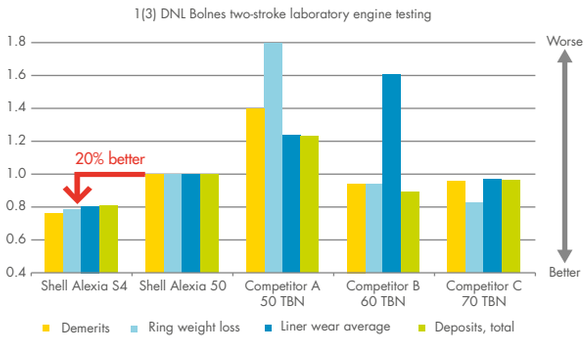
SHELL ALEXIA S4 IS A SINGLE, ALL-PURPOSE CYLINDER OIL THAT CAN BE USED WITH DISTILLATES* AND RESIDUE FUEL OIL WITH UP TO 3.5% SULPHUR LEVELS AND IN ALL ENVIRONMENTS: POLAR TO TROPICAL.

REDUCED COSTS

We appreciate that you need to drive down costs. That is why new Shell Alexia S4 underwent rigorous development and testing at the Marine and Power Innovation Centre in Hamburg, Germany. Because Shell Alexia S4 is designed to target all four oil stress factors, it provides better wear protection** than Shell Alexia 50 and all the oils in the current market that we tested.

Shell Alexia S4 can help reduce costs in different ways:

- It helps to mitigate the risk of failure and the costs associated with unplanned breakdowns and maintenance.
- It offers an opportunity to optimise your lubricant feed rate.
- It can be used at the same feed rates as BN70 cylinder oils.
- It is an all-purpose cylinder oil that eliminates the requirement for a more expensive cylinder oil when using low-sulphur fuel.



ENHANCED PROTECTION: Shell Alexia S4 provides up to 20% better protection than Shell Alexia 50 and beats all the other oils in the market that we tested in our laboratory engine under simulated slow-steaming, high-acid-stress conditions.

**As measured in laboratory engine tests under simulated high-acid-stress test conditions.

REDUCED FEED RATE

Shell Alexia S4 has a BN of 60, but all our field trials have been performed using the same lower feed rate that would be used for a BN70 product. This means that customers switching from Shell Alexia 50 (BN70) do not need to adjust their feed rates.

Compared with using other BN60 products at engine manufacturers' BN60 feed-rate guidelines, using Shell Alexia S4 could mean a saving of up to14 t/y of lubricant for a MAN-engine-powered very large crude carrier or up to 52 t/y for a Wärtsilä-engine-powered container vessel.

Some customers may have an opportunity to further optimise their lubricant feed rates and thereby reduce their expenditure on cylinder oil with minimal impact on maintenance costs. Because Shell Alexia S4 is underpinned by rigorous scientific understanding, we have the confidence to work with our customers to help them optimise their feed rates, thereby helping them to move towards the minimum engine-manufacturer's guidelines for oil feed rates.

Each 0.1-g/kWh reduction in oil feed rate can translate into significant cylinder oil consumption savings. For example, a very large crude carrier with a MAN B&W engine could save up to 14 t/y of lubricant through reducing feed rates by 0.1 g/kWh, and a container ship with a Wärtsilä–Sulzer engine could save up to 37 t/y.

Ask us how we can work with you on a feed-rate optimisation programme.

TECHNOLOGY LEADERSHIP

Shell invests about $1 billion every year in research and development across the whole group and considers technology leadership to be a critical component in ensuring the delivery of practical and reliable solutions for today's challenges.

Shell Alexia S4 was developed in-house by Shell and is based on a breakthrough in the understanding of oil stress in two-stroke diesel engines and an appreciation of the changes in external environment. This work builds on a 20-year heritage in the understanding of oil stress in four- and two-stroke engines.

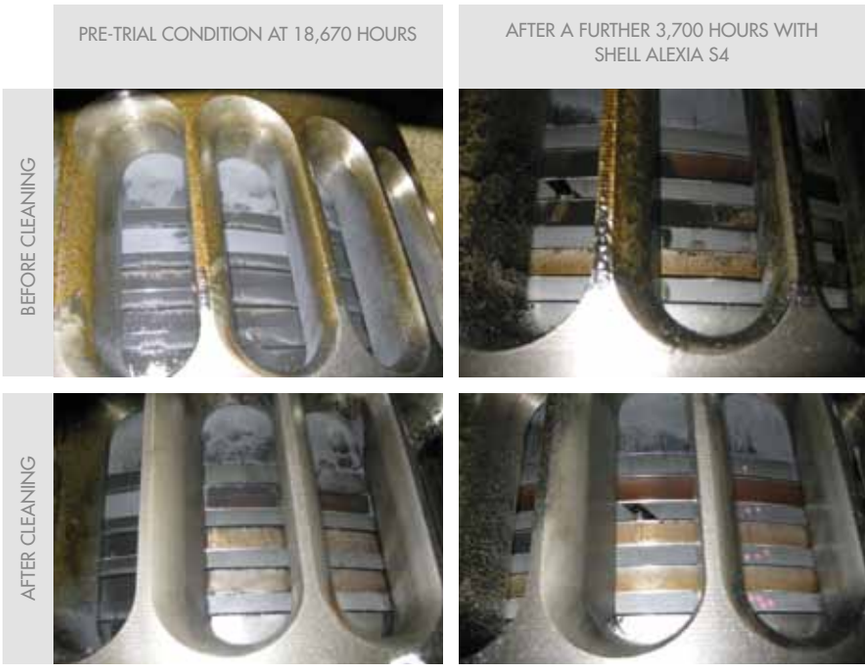
Shell is the only oil company with a dedicated range of marine test engines, including the Bolnes two-stroke engine used in the development and testing of new Shell Alexia S4. Our rigorous scientific approach, combined with an extensive engine and field trial programme, gives us great confidence in the performance of Shell Alexia S4's unique formulation, which is currently being patented.

We do not just offer an outstanding cylinder oil; we provide a total lubrication concept that consists of the right product, the right tools and the right people to help our customers optimise their operations.

Our range of technical services, such as Shell Rapid Lubricants Analysis and Shell ANALEXAlert, and expert knowledge of engine conditions backed by many years' experience of inspecting engines and providing lubrication advice can help customers to manage their operations more efficiently through longer maintenance intervals and/or optimising cylinder oil feed rates.

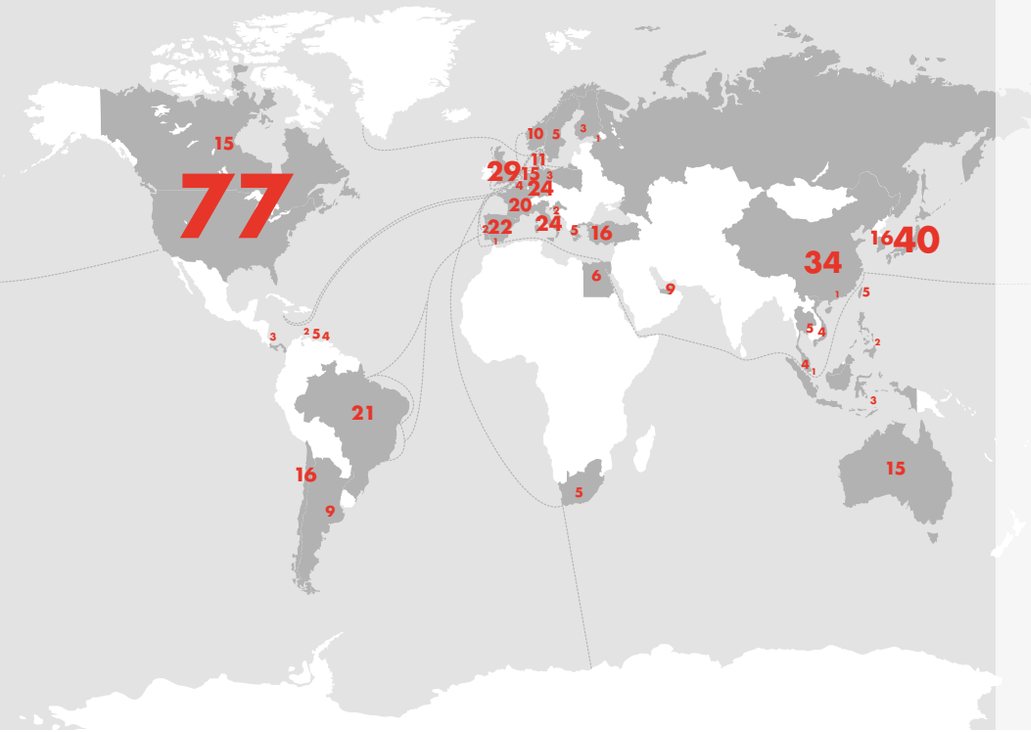
Working in long-term partnerships with our customers and key engine manufacturers, we believe that we will continue to push the established boundaries of operational efficiency with Shell Alexia S4.

PROVEN PERFORMANCE IN THE REAL WORLD



EXCEPTIONAL CLEANLINESS: After thousands of hours, pistons running with Shell Alexia S4 showed exceptional cleanliness. This example shows a piston from one of our field trial vessels sailing between Europe and the Caribbean, with a MAN 8S60ME-C engine, burning fuel with sulphur contents from 1 to 2.7%. This piston started the trial with18,670 running hours and was previously lubricated with Shell Alexia 50 (left column). After a further 3,700 hours, this time with Shell Alexia S4 which is designed to target all aspects of oil stress, the piston's condition is still excellent, with almost no wear visible (right column).

SHELL ALEXIA S4 HAS ACCUMULATED OVER 20,000 HOURS OF SERVICE IN A RIGOROUS FIELD TRIAL PROGRAMME TO TEST ITS PERFORMANCE UNDER THE MOST CHALLENGING CONDITIONS.



COMPREHENSIVE FIELD TRIALS: Shell Alexia S4 has accumulated over 20,000 hours of service in a rigorous field trial programme to test its performance under the most challenging conditions. It has been used on containers, tankers and bulkers, with fuels ranging from distillate to high-sulphur residual fuel. To identify the changes under humidity stress, the climatic conditions ranged from the dry air of the Suez Canal to the extreme humidity of the Amazon basin. Other vessels faced the cold and ice of the Antarctic Ocean. All the major manufacturers' engines (MAN, Wärtsilä and Mitsubishi) were included in the trial, along with modern and old, and large and small engines. These engines were run at high and low loads, from 15 to 95% of the maximum continuous rating.

WORLDWIDE AVAILABILITY: Shell Alexia S4 will be available from about 500 ports globally.

KEY

FIELD TRIAL ROUTES

32 AVAILABILITY, NUMBER OF PORTS PER COUNTRY

SHELL ALEXIA S4 IS CYLINDER OIL REINVENTED. IT IS A COMPLETELY NEW FORMULATION BUILT ON A BREAKTHROUGH IN THE UNDERSTANDING OF OIL STRESS IN LOW-SPEED, TWO-STROKE DIESEL ENGINES AND THE NEED FOR REDUCED COSTS AND GREATER OPERATIONAL SIMPLICITY.

Shell
Alexia S4

Contact your Shell Marine Products account manager to find out more or visit
www.shell.com/marine

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